

The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of Jim Snell, 301-903-4094, or Internet address jim.snell@hq.doe.gov, so we may issue a correction.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-17

April 18 through April 24, 1997

Table of Contents

EVENTS	1
1. ANTI-CONTAMINATION COVERALLS CATCH FIRE AT HANFORD.....	1
2. FAILURE TO REPLACE FUSES CAUSES DAMAGE TO CRANE BRAKING SYSTEM	2
3. VISITING ENGINEER SHOCKED WHILE INSPECTING FAILED CAPACITOR	3
4. NONCOMPLIANCE WITH VENTILATION TEST SCHEDULES.....	6
5. TYPE A ACCIDENT INVESTIGATION RESULTS FOR WELDER FATALITY ARE NOW AVAILABLE	7
6. WORKSHOP ON CHEMICAL SAFETY	7



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EVENTS

1. ANTI-CONTAMINATION COVERALLS CATCH FIRE AT HANFORD

On April 10, 1997, at Hanford, a radiological control technician's anti-contamination coveralls caught fire when he stepped too close to a space heater. The technician was in a temporary tent where he was performing radiological surveys on trucks leaving a contamination area. Another worker noticed the flames and alerted the technician. The technician extinguished the flames by patting them with his glove and was not burned. This event is significant because the potential for fire was unexpected and the technician could have been severely burned if the second individual had not noticed the fire. (RL--BHI-REMACT-1997-0004)

A diesel-fueled space heater (55,000 BTU/hr) with an electrical ignition and fan was operating inside the tent to provide temperature control. The fan had been operating for about 3 hours before the event occurred. The heater was approximately 1 to 2 feet behind the technician, separated from him by scaffolding bracing. Investigators believe the technician's cotton-polyester anti-contamination coveralls ignited when he stepped back and placed his right leg next to the heater. The right leg of the coveralls caught on fire and burned a hole approximately 6 to 8 inches in diameter at the mid-calf. The insulated coveralls the technician wore under the anti-contamination coveralls were slightly discolored from the fire, but were otherwise undamaged.

This is the second reported event in 1997 where a worker's anti-contamination clothing caught fire. On February 13, 1997, at the Oak Ridge K-25 Site, a welder was fatally burned when his two layers of anti-contamination clothing caught fire, engulfing him in flames. All of the welder's clothing was cotton. A DOE Type A accident investigation was conducted in accordance with DOE 225.1, *Accident Investigations*. Information regarding the availability of the Accident Investigation Board's report is given in article 5 on page 7 of this Weekly Summary. As a result of the February 13 event, Hanford management requires personnel working in contaminated areas near open flames or ignition sources to wear flame-retardant anti-contamination clothing.

Hanford investigators determined that the diesel-fueled space heater was not an open ignition source and the technician did not violate site policy by wearing cotton-polyester coveralls. Investigators tried to recreate the event by placing the coveralls near the running heater for approximately 10 minutes. However, the coveralls did not ignite.

This event is similar to a clothing-fire event that occurred at the Brookhaven National Laboratory on December 6, 1991. A contractor was heating quartz tubing to over 1,000 degrees Fahrenheit when his cotton-polyester lab coat contacted the tubing. The coat caught fire, and a portion of the material melted. The contractor extinguished the flames by patting them with his ungloved right hand. Some of the melted material from the coat stuck to his hand, causing second and third degree burns. As a corrective action personnel were instructed not to wear flammable clothing when working near open flames or extremely hot objects. (ORPS Report CH-BH-BNL-BNL-1991-1015)

Operating Experience and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for burn injuries and found 45 reports involving burn injuries. Thirteen percent of the burn injuries were caused by open flames. Figure 1-1 shows the various burn injury sources DOE-wide.

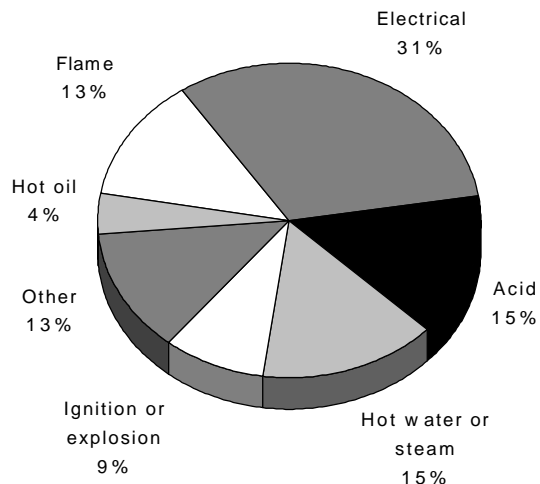


Figure 1-1. Sources of Burn Injuries DOE-wide¹

These events illustrate the potential hazards when personnel clothing comes in contact with flames or hot objects. DOE O 440.1, *Worker Protection Management for DOE Federal and Contractor Workers*, requires DOE site organizations to implement a written worker protection program that provides a place of employment free from recognized hazards that are causing or are likely to cause death or serious physical harm. The Order also requires facilities to implement a hazard prevention and abatement process to ensure identified hazards are managed through final abatement and control. When a serious hazard is identified, management must assess the process and take applicable steps to prevent, abate, or mitigate the hazard.

KEYWORDS: fire, anti-c clothing, industrial safety

FUNCTIONAL AREAS: industrial safety, radiation protection

2. FAILURE TO REPLACE FUSES CAUSES DAMAGE TO CRANE BRAKING SYSTEM

On April 17 1997, at the Hanford Fast Flux Test Facility, an electrician failed to replace fuses in two electrical panels for containment polar crane brakes, resulting in minor brake damage. A craftsperson controlling the crane observed smoke coming from the crane trolley platform. The craftsman secured the crane and requested that the fire department be called. The containment was evacuated. Investigators determined that the smoke was caused by the crane drums attempting to rotate while the drum brakes were engaged. The brakes did not release when the drums were energized because an electrician did not replace fuses in two brake electrical panels following maintenance. Failure to properly return the crane to service following maintenance resulted in minor equipment damage. (ORPS REPORT RL--PHMC-FFTF-1997-0004)

¹OFAF engineers reviewed the ORPS database for the nature of occurrence codes 3A (Occupational Illness/Injuries) AND 3C (Safety Concerns) AND 10C Potential Concerns Issues AND all narrative "burn" OR "burns" and found 45 reports. A 100 percent review of the reports was used to determine the sources of burns.

The containment polar crane, located approximately 80 feet above the containment floor, has two hoists, a main hoist (approximate capacity 200 tons) and an auxiliary hoist (approximate capacity 25 tons). Electricians perform monthly maintenance and inspections of the crane as part of the facility preventive maintenance program. An electrician, familiar with the maintenance work, removed two fuses in each of four panels that supply power to the hoist brakes. He placed the fuses at the bottom of each cabinet. After the electrician completed the mechanical work, a second electrician was tasked with replacing the fuses. The second electrician replaced fuses in only two of the four panels because he did not realize that each set of brakes received power from two electrical panels. Because the brakes are automatically engaged when not energized, they did not release when the crane hoists were activated.

Investigators examined the brake shoes for both hoists and observed slight damage on the shoes of the auxiliary hoist. There was no damage to the shoes for the main hoist. As a precautionary measure, all the shoes in both hoists were replaced. Investigators are reviewing the event to determine the causes and corrective actions. They are evaluating four areas: (1) adequacy of the preventive maintenance procedure, (2) worker knowledge of the task, (3) adequacy of the job turnover, and (4) better methods of fuse control.

NFS reported on inadequately sized, loose, or defective fuses in Weekly Summaries 95-20, 95-06, 94-27, 94-22, 94-20, 94-04, 94-02, 93-47, 93-45, 93-41, 93-09, and 92-27. Weekly Summary 93-09 reported that operators at a tritium production facility at Savannah River declared a primary engineered safety feature actuation system inoperable because the fuses in redundant power supplies were undersized. Operators found one of the fuses blown. Investigators could not determine when the undersized fuses were installed. (ORPS Report SR--WSRC-ETF-1993-0008)

This event illustrates the importance of properly returning a crane or other equipment to service after maintenance. DOE-STD-1090-96, *Hoisting and Rigging*, provides guidance on maintenance of hoisting and rigging equipment. Chapter 7 provides guidance on preventive maintenance, operations, and inspections for overhead and gantry cranes. DOE 5480.19, *Guidelines for the Conduct of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," states that procedures should be referenced during infrequent or unusual evolutions, when the worker is not intimately familiar with the procedure requirements, or when errors could cause significant adverse impact to the facility. DOE facility managers should ensure that all workers and supervisors are familiar with procedures and understand their purpose and use.

KEYWORDS: crane, maintenance, post-maintenance testing, procedure, qualification

FUNCTIONAL AREAS: industrial safety, training and qualification

3. VISITING ENGINEER SHOCKED WHILE INSPECTING FAILED CAPACITOR

On April 15, 1997, at Los Alamos National Laboratory, a visiting engineer for a capacitor manufacturer received an electrical shock when he reached into a damaged capacitor case. The engineer was to direct a post-mortem inspection on the capacitor as part of a project to test-to-failure large (600 lb, 60 kV, 30 kJ) high-energy storage capacitors in a high-voltage set-up. A special electrical work permit governing the activities for the post-mortem did not allow the engineer to perform hands-on activities. However, the project leader escorting the engineer was not aware of the work permit and its associated restrictions. Although no one was injured, the lack of control of the visiting engineer placed him at risk for an electrical hazard. (ORPS Report ALO-LA-LANL-PHYSCOMPLX-1997-0001)

The project leader escorted the engineer to the test bay to visually inspect the capacitor. The engineer inspected the condition of the insulation, case, and some elements that came out of the case during failure. Eventually, he reached into an opening in the case and removed individual elements for a more detailed inspection. One of the elements discharged residual energy. At this point, the project leader suggested halting the inspection, but the engineer reached in for a second element. This element also discharged. At this point, the project leader escorted the engineer from the area. The test bay crew covered the capacitor for safe storage until it could be shipped to the manufacturer for the remainder of the post-mortem.

Before work on the post-mortem began, the test bay supervisor and deputy group leader decided that a special electrical work permit would be required because of hazards associated with cutting the fiberglass capacitor case material; containing the capacitor mineral oil; and, most importantly, contacting individual capacitive elements that might still retain electrical energy. The work permit prohibited the visiting engineer from performing any hands-on activities because he was not under contract.

Investigators determined that the project leader was unaware that a special electrical work permit had been written to cover post-mortems. Therefore, he did not explicitly tell the visiting engineer he could not take a hands-on role in the test bay. The test bay supervisor had the special electrical work permit with him at a group meeting and planned to post it at the test bay after the meeting. He did not know the inspection had been conducted and the activities halted. Investigators also determined there was no visitor briefing on facility hazards and no procedures or controls addressing post-testing activities to ensure all elements of the capacitor were discharged. They also determined that the engineer asked for a utility knife to short the capacitor internals and a test crew member gave him one.

NFS reported events involving facility visitors in Weekly Summaries 96-34, 96-25, 96-20, 96-15, 95-38, and 95-04. Although many of these events involved controlling visitors within radiologically controlled areas, visitors can also be exposed to other hazards, such as electricity, chemicals, explosives, and high-energy beams. Weekly Summary 96-34 reported on that August 15, 1996, at Lawrence Livermore National Laboratory, a visitor received an electrical shock while testing a photo-multiplier tube. Investigators believe the shielding surrounding the tube became capacitively charged to 3,000 volts by the tube. (ORPS Report SAN--LLNL-LLNL-1996-0039)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for events involving visitors at DOE facilities across the complex and found 46 occurrence reports. Figure 3-1 shows that facility managers reported personnel error as the root cause for 49 percent of the occurrences. They also reported that management problems accounted for 36 percent of the occurrences. Further review shows that 50 percent of the personnel errors were reported as procedure not used or used incorrectly.

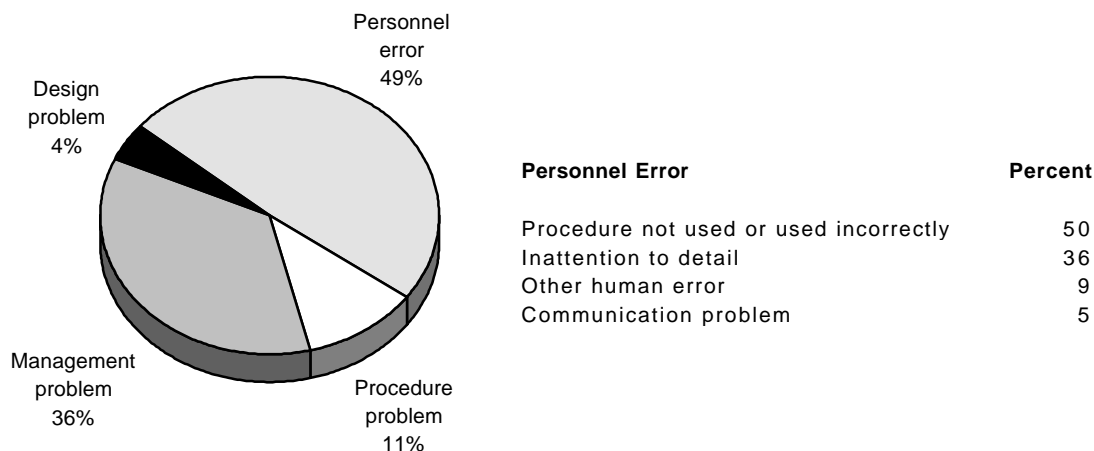


Figure 3-1. Distribution of Root Causes for Events Involving Visitors¹

This event illustrates the importance of escorts and sponsors ensuring that visitors understand and follow facility safety rules and procedures. Visiting engineers and skilled technicians are not immune to the hazards associated with their field of expertise. Escorts should be trained and should understand their responsibilities for visitor and facility safety. Escorts for visitors who require entry into radiologically controlled areas should review DOE/EH-0256T, *Radiological Control Manual*. The manual provides guidance on visitor entry requirements in article 336 and guidance for escort training in articles 622 and 657. Personnel should be aware of the stored electrical energy and shock hazard of capacitive discharge. Personnel can be shocked from charged capacitors even if the equipment has been turned off or disconnected from external power. As seen in this event, the damaged capacitor still contained elements that sustained an electrical discharge.

Facility managers should review the OSHA regulations contained in 29 CFR 1910, sub-part S, "Electrical"; 29 CFR 1926, sub-part K, "Electrical"; and 29 CFR 1926, sub-part V, "Power Transmission and Distribution." The regulations in 29 CFR 1910.147(d)(5) and .333(b)(2) require discharging, short-circuiting, and grounding capacitors if the stored electric power could endanger personnel. DOE-HDBK-1011/2-92, *DOE Fundamentals Handbook Electrical Science*, volume 2, contains an instructional section on capacitance.

The section includes descriptions of capacitors, circuit diagrams, and electrical equations. DOE/ID-10600, *Department of Energy Electrical Safety Guidelines*, chapter 2.0, states that capacitive devices may retain or build up a charge, so the circuit should be shorted or grounded.

KEYWORDS: electrical shock, visitor, capacitor, permit

FUNCTIONAL AREAS: industrial safety, operations

¹ OEAF engineers searched the ORPS database for All Narrative ("visitor") and retrieved 118 occurrence reports. A 100 percent review of these reports yielded 46 reports on visitor issues.

4. NONCOMPLIANCE WITH VENTILATION TEST SCHEDULES

On April 18, 1997, at Oak Ridge National Laboratory, a contractor conducting a review of the operational safety requirements for a building at the Radiochem Engineering Development Center discovered that an efficiency test of high-efficiency particulate air filters for an exhaust system had not been conducted in accordance with surveillance requirements. The air filters are in a ventilation system that handles exhaust from the men's change room. The contractor's review identified that quality engineering and inspection personnel had not performed an efficiency test on the filters since October 1995. The facility manager suspended operations involving nuclear materials pending a review of operational safety requirement compliance. This issue is significant because failure to conduct tests and inspections at required frequencies violates operational safety requirements and technical safety requirements that represent the minimum acceptable controls necessary to ensure safe operation. (ORPS Report ORO--ORNL-X10REDC-1997-0003)

On October 10, 1995, quality engineering and inspection personnel performed an efficiency test on the exhaust system filters. The filters failed the test, and inspectors placed a hold tag on them. Building maintenance personnel replaced the filters and returned the system to service on November 9, 1995. However, they did not contact the quality engineering and inspection organization to have the hold tag removed and a post-replacement efficiency test performed. Inspectors did not perform the subsequent efficiency tests because there was a hold tag. Inspectors successfully tested the filters on April 18, 1997, after the missed tests were discovered. An investigation team is reviewing this event for corrective actions and lessons learned.

Weekly Summary 97-15 reported that management problems accounted for 66 percent of the root causes for missed or past-due surveillances and inspections as reported by facility managers in the Occurrence Reporting and Processing System. Personnel errors accounted for 18 percent of the occurrences, and 36 percent of the management problems were identified as inadequate administrative control.

This event illustrates a lack of communication between the organization that has ownership of the operational safety required system and the organization that tests the system to ensure it meets specified requirements of operability. Work packages for component replacement or equipment repair should address required post-replacement or post-maintenance testing requirements to ensure they are not missed. Systems or components that are returned to service are not operable until tested and verified.

DOE facility managers should periodically review their surveillance test procedures to ensure that scheduled tests have been performed at the frequencies specified in their safety documentation. DOE 5480.22, *Technical Safety Requirements*, general principle 1, states: "A system is considered operable as long as there exists assurance that it is capable of performing its specified safety function(s)." Surveillance testing is essential in providing this assurance.

KEYWORDS: surveillance, test, communication, operational safety requirement

FUNCTIONAL AREAS: surveillance, licensing/compliance

5. TYPE A ACCIDENT INVESTIGATION RESULTS FOR WELDER FATALITY ARE NOW AVAILABLE

On February 13, 1997, at the Oak Ridge K-25 Site, a welder was fatally injured when his anti-contamination clothing and coveralls caught fire. The welder was using a cutting torch in a contaminated cell area. At the time of the accident, he was wearing multiple layers of protective clothing, a respirator, and a welder's mask. On February 14, 1997, the Department of Energy Assistant Secretary for Environment, Safety and Health appointed a Type A Accident Investigation Board to investigate the accident in accordance with DOE 225.1, *Accident Investigations*. (ORPS Report ORO--LMES-K25GENLAN-1997-0001)

The Board completed their investigation and prepared a final report that provides an analysis, identification of contributing and root causes, and judgments of need. The Board's report will be distributed this week and will also be available on the Department of Energy Accident Investigation Home Page during the week of April 28, 1997. The url for the home page is http://nattie.eh.doe.gov:80/web/eh2/acc_inv.html. In addition to the report, readers who access the home page will be able to view a representative burn test of anti-contamination clothing and work coveralls similar to those worn by the welder at the time of the accident.

OEAF engineers will also review the report and prepare an article for a future issue of the OE Weekly Summary.

6. WORKSHOP ON CHEMICAL SAFETY

On July 23-24, 1997, the Department of Energy (DOE) Office of Worker Health and Safety and the Chemical Manufacturers Association (CMA) will hold a workshop at the CMA Headquarters in Arlington, Virginia. The workshop will provide a forum where representatives from the chemical industry and DOE can share "best practices" for meeting management's chemical safety responsibilities and senior managers can share information on how chemical safety affects the bottom line of an organization. The workshop will also cover technical issues that are targeted at the line manager or safety professional responsible for implementing or improving a chemical safety program. The workshop initiates a mutual assistance network for environment, safety, and health within DOE and between DOE and the CMA, at the manager and practitioner levels, in the spirit of a memorandum of understanding between the CMA and DOE.

Information about the workshop and the agenda is available on the DOE Chemical Safety Home Page. The url for the home page is http://tis-hq.eh.doe.gov/web/chem_safety. Individuals with questions, comments, or suggestions, and those who plan to attend the workshop, should contact Christina Heide at Link Technologies, 20251 Century Blvd., Germantown, MD, 20874 or at (301) 515-9654.